MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

ETM3056 – MULTIMEDIA AND COMMUNICATION NETWORKS

(TE)

9 FEBRUARY 2023
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 4 pages excluding the cover page.

2. Answer **ALL** questions . All questions carry equal marks and the distribution of the marks for each question is given .

3. Please write all your answers in the answer booklet provided .

QUESTION 1 [25 MARKS]

a) Explain **TWO** important features of continuous media. Give **ONE** example of continuous and non-interactive media.

[5 marks]

b) Five symbols [B,E,S,T,!] are used with the following estimated probability

$$P(B)=0.5,\ P(E)=0.3,\ P(S)=0.2,\ P(T)=0.1,\ P(!)=0.1$$

(i) Determine the code and number of bits to encode message "EEE" by using arithmetic coding, as shown below.

```
BEGIN
   low = 0.0;    high = 1.0;    range = 1.0;

   while (symbol != terminator)
        {
          get (symbol);
          low =  low + range * Range_low(symbol);
          high = low + range * Range_high(symbol);
          range = high - low;
        }

   output a code so that low <= code < high;
END
```

[8 marks]

(ii) Discuss the advantages of arithmetic coding over Huffman coding algorithm.

[4 marks]

(iii) What is the drawback of arithmetic coding algorithm?

[4 marks]

c) Consider the following Differential Pulse Code Modulated (DPCM) sequence. Reconstruct the original signal.

+4 +2 +3 -2 +3 -1 +1 +1

[4 marks]

Continued...

QUESTION 2 [25 MARKS]

a) Compare additive mixing and subtractive mixing in the image color production scheme.

[6 marks]

b) A video clip requires 4CIF video resolution (704 x 576) with 24 bits per pixel. Assuming that the frame rate is 25 fps and the duration of the clip is 30 minutes, determine how many video clips of the same specifications can be stored on a hard disk with capacity of 1 TB.
Also, suggest **TWO** techniques to increase the number of video clips on the 1TB hard disk

[8 marks]

c) Compare **THREE** frame types used in MPEG.

[6 marks]

d) Discuss the advantage of nonlinear quantization in the case of audio signals.

[5 marks]

Continued...

QUESTION 3 [25 MARKS]

a) Telephone networks such as Public Switched Telephone Networks (PSTN) may provide both analog and digital services to the users.

(i) Name two types of analog services supported by telephone networks. Briefly describe the working principle of analog services.

[4 marks]

(ii) Name two types of digital services supported by telephone networks. Briefly describe the working principle of digital services.

[4 marks]

(iii) If a user wants to have a data service at rate of 60kbps, what type of services are suitable to this user? Justify your answer.

[3 marks]

b) T1 line speed is constant. Explain how T-1 line can be used to carry twice the number of calls.

[3 marks]

c) Switch is one of the commonly used network devices in the second layer of Open System Interconnection (OSI) model.

(i) Briefly compare **TWO** differences between a layer 2 switch and a bridge.

[4 marks]

(ii) Explain the drawback of using a layer 2 switch.

[2 marks]

(iii) Consider a pair of terminals, A and B, which are communicating between each other via a transmission path passing through a switch, S1, as shown in Figure 1. Given that a 64-kilobyte message is transmitted from A to B. The network limits packets to a maximum size of 2-kilobytes, and each packet has a 32-byte header. The transmission lines in the network are error free and have a speed of 50 Mbps. Each hop is 100km long. Calculate the time taken for a message from a source to reach the destination.

[5 marks]

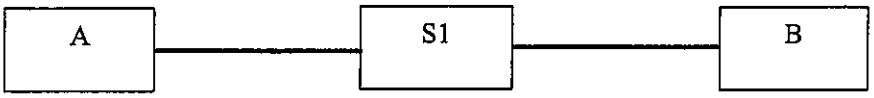

Figure 1

Continued...

QUESTION 4 [25 MARKS]

a) Worldwide Interoperability for Microwave Access (WiMAX) is a wireless broadband technology developed based on IEEE 802.16 standard.
Explain:

(i) **TWO** functions of WiMAX base stations in the access service networks, by referring to network architecture illustrated in Figure 2.

[4 marks]

(ii) Channel bandwidth allocation technique.

[8 marks]

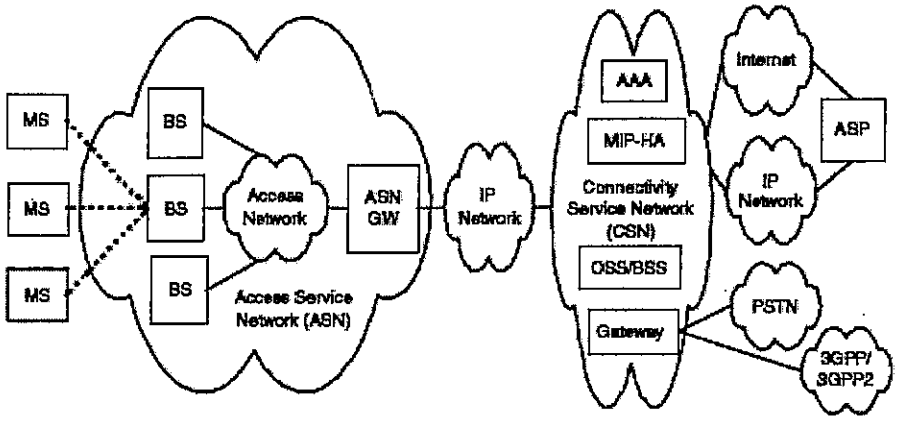

Figure 2

b) Long-term Evolution (LTE) is a fourth generation (4G) wireless standard that provides increased network capacity and speed for cellphones and other cellular devices as compared to the predecessor.

(i) Discuss how LTE can achieve adaptive modulation.

[4 marks]

(ii) Explain the multiple access techniques, Orthogonal Frequency Division Multiple Access (OFDMA) and the Single-Carrier Frequency Division Multiple Access (SC-FDMA), employed in the downlink and uplink of a LTE system.

[6 marks]

(iii)Name type of handover supported by LTE.

[3 marks]

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